

Tilburg University

Duration dependency and unobserved heterogeneity in unemployment time series

van Ours, J.C.

Published in:
Economics Letters

Publication date:
1992

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):
van Ours, J. C. (1992). Duration dependency and unobserved heterogeneity in unemployment time series. *Economics Letters*, 38(2), 199-206.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Duration dependency and unobserved heterogeneity in unemployment time series

An empirical analysis for the Netherlands *

J.C. van Ours

Free University, Amsterdam, Netherlands

Received 18 July 1991

Accepted 15 August 1991

Aggregate escape probabilities from unemployment decrease with the duration of unemployment. By analyzing fluctuations in escape probabilities from different duration classes over time, we are able to make a distinction between the effect of duration dependency and heterogeneity on the aggregate escape probability. For Dutch unemployment it appears that the heterogeneity effect is the dominating effect. There is no indication of duration dependency.

1. Introduction

In many European countries long-term unemployment became a serious problem in the eighties. In the Netherlands the number of long-term unemployed (workers who are unemployed for more than 1 year) increased from 300.000 in 1980 to 800.000 in 1984. As a percentage of total unemployment long-term unemployment increased from 25% in 1980 to 55% in 1984. In the course of the eighties total unemployment decreased to 600.000 in 1990, but the percentage of long-term unemployed hardly decreased.

An important topic in the discussion about unemployment is whether or not the individual escape rates from unemployment decrease with the duration of the unemployment spell. If so long-term unemployment is selfsustaining and requires different policy measures than if there is no duration dependency. With duration dependency job creation may be very important; without duration dependency stimulating education may be more important.

Analyses on escape or hazard rates from unemployment are usually based on cross-sectional data. One of the empirical problems in these studies is the effect of unobserved heterogeneity on the hazard rate. If this is not accounted for, one may find fallacious negative duration dependency. Dutch studies are inconclusive with respect to duration dependency. Kooreman and Ridder (1983) using aggregate data found duration dependency for female unemployed, but not for male

Correspondence to: J.C. van Ours, Free University, Department of Economics, Applied Labour Economics Research Team (ALERT), P.O. Box 7161, 1007 MC Amsterdam, The Netherlands.

* The author wishes to thank Gerard van den Berg for his comments on a previous version of this article.

unemployed. Van Opstal and Theeuwes (1986) using micro data on youth unemployment spells are inconclusive. Ridder (1987) and Gorter, Nijkamp and Rietveld (1991) find no significant negative or positive duration dependency. Groot and Ter Huurne (1988) is the only study which concludes that there is negative duration dependency of the escape probability from unemployment.

This article uses time series of Dutch unemployment data to distinguish between the effect of duration dependency and the effect of (unobserved) heterogeneity on the escape rate from unemployment. A similar study based on time series for the UK was done by Jackman and Layard (1991), who distinguish a pure heterogeneity effect from a mixture of heterogeneity and duration dependency. They conclude that there is no pure heterogeneity effect but also the effect of duration dependence, indicating long-term unemployed being demoralized and stigmatized in the eyes of employers. Jackman and Layard have no test to distinguish between both effects. We present a test to do so, a test which is based on the analysis of fluctuations in escape probabilities over time. We conclude that in the Netherlands escape rates from unemployment are not duration dependent. A pure heterogeneity effect can explain why aggregated escape probabilities from unemployment are lower for long-term unemployed.

2. Long-term unemployment in the Netherlands

The development of unemployment in the Netherlands in the eighties is shown in fig. 1. The number of unemployed increased rapidly in the beginning of the eighties from 300.000 in 1980 to 800.000 in 1983. After 1984 unemployment declined to about 650.000 in 1990. The number of unemployed for more than 1 year shows approximately the same development: an increase in the

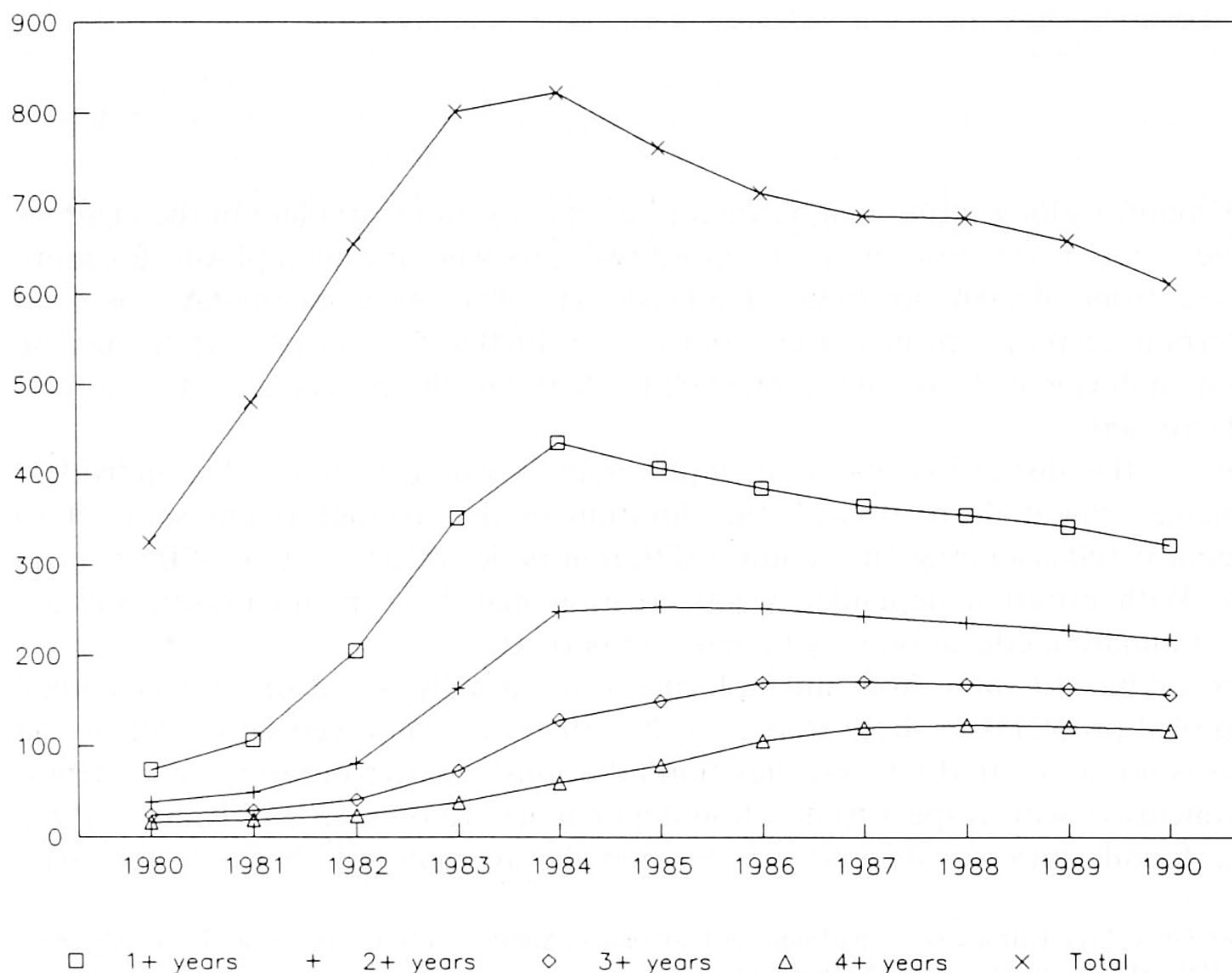


Fig. 1. Unemployment in the Netherlands, 1980–1990.

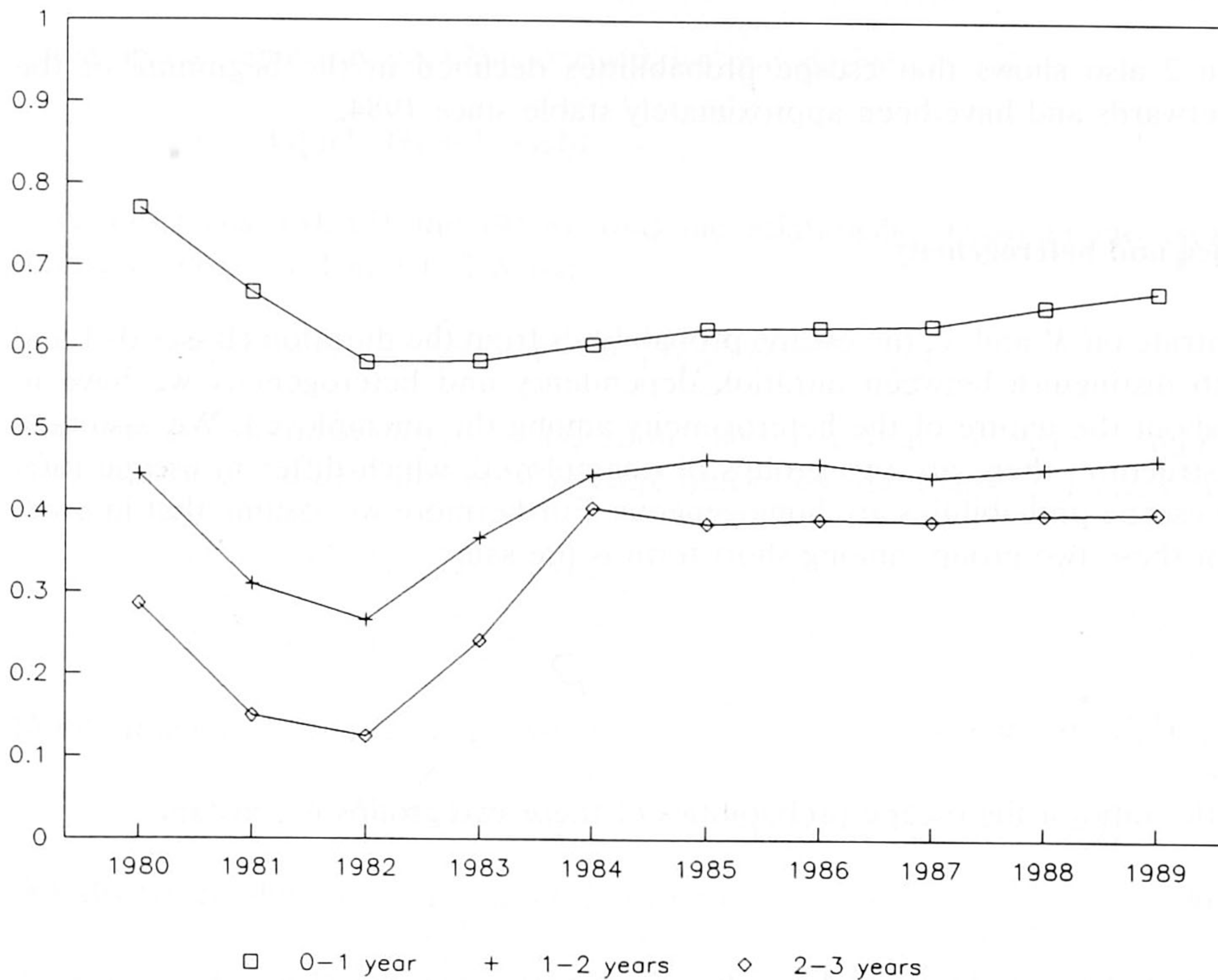


Fig. 2. Escape probabilities from unemployment by duration class.

period 1980–1984, a decrease in the period 1984–1990. The numbers of unemployed for more than 2, 3 or 4 years increase more slowly in the beginning of the eighties and show hardly any decrease afterwards.

We have information on the numbers of unemployed from successive duration classes (0–1, 1–2, 2–3, 3–4, 4+ years) over a period of time. This enables us to calculate the outflow from the different duration classes. It is for example obvious that the outflow from duration class 0–1 years in 1980 is equal to the number of unemployed in the duration class 1–2 years in 1981 minus the number of unemployed in the duration class 0–1 years in 1980.

Combining the information on the outflows and stocks, we calculate outflow or escape probabilities from unemployment. Let A_t^s be the flow out of the unemployment in year t from duration class 0–1 years, A_t^l be the outflow from the unemployment from duration class 1–2 years and A_t^z be the outflow from unemployment duration class 2–3 years. Then the yearly escape probabilities from these unemployment classes are:

$$\lambda_t^s = A_t^s / U_t^s,$$

$$\lambda_t^l = A_t^l / U_t^l,$$

$$\lambda_t^z = A_t^z / U_t^z,$$

(1)

in which λ^s , λ^l and λ^z are escape probabilities.

The development of these escape probabilities during the eighties is shown in fig. 2. Obviously $\lambda^s > \lambda^l > \lambda^z$. So the longer the unemployment duration the smaller the escape probability from

unemployment. Figure 2 also shows that escape probabilities declined in the beginning of the eighties, increased afterwards and have been approximately stable since 1984.

3. Duration dependence and heterogeneity

We will first concentrate on λ^s and λ^l , the escape probabilities from the duration classes 0–1 and 1–2 years. In order to distinguish between duration dependency and heterogeneity we have to make an assumption about the nature of the heterogeneity among the unemployed. We assume a simple heterogeneity structure: there are two groups of unemployed, which differ in escape rate. Within the groups the escape probabilities are homogeneous. Furthermore we assume that in every year the distribution of these two groups among short term is the same:

$$\begin{aligned} U_{1,t}^s &= \mu U_t^s \\ U_{2,t}^s &= (1 - \mu) U_t^s, \quad 0 < \mu < 1. \end{aligned} \quad (2)$$

Next we assume that the ratio of the escape probabilities of these two groups is constant:

$$\lambda_{2,t}^s / \lambda_{1,t}^s = \Theta_1. \quad (3)$$

Finally we assume that if there is duration dependence, then this has the same effect on both groups:

$$\lambda_{1,t}^l / \lambda_{1,t}^s = \lambda_{2,t}^l / \lambda_{2,t}^s = \Theta_2. \quad (4)$$

With these rather simple assumptions we are able to make a distinction between the influence of unobserved heterogeneity and duration dependence. Of course:

$$\begin{aligned} A_{1,t}^s &= \lambda_{1,t}^s U_{1,t}^s, \\ A_{2,t}^s &= \lambda_{2,t}^s U_{2,t}^s. \end{aligned} \quad (5)$$

Since $A_t^s = A_{1,t}^s + A_{2,t}^s$ we get, from combining eqs. (2) and (5):

$$A_t^s = [\lambda_{1,t}^s \cdot \mu + \lambda_{1,t}^s \cdot (1 - \mu)] U_t^s, \quad (6)$$

which by using eqs. (1) and (3) becomes:

$$\lambda_t^s = \lambda_{2,t}^s (\mu \cdot \Theta_1 + 1 - \mu). \quad (7)$$

In the duration class 1–2 years the share of both groups of unemployed is defined by using μ^* . Unlike μ , however, μ^* may fluctuate over time:

$$\begin{aligned} U_{1,t}^l &= \mu_t^* U_t^l, \\ U_{2,t}^l &= (1 - \mu_t^*) U_t^l, \quad 0 < \mu_t^* < 1. \end{aligned} \quad (8)$$

Then, in the same way eq. (7) is derived, we may derive:

$$\lambda_t^l = \lambda_2^l (\mu_t^* \cdot \Theta_1 + 1 - \mu_t^*). \quad (9)$$

Combining eqs. (4), (7) and (9) we find the relationship between the escape probabilities from duration classes 0–1 and 1–2 years:

$$\lambda_t^l / \lambda_t^s = \Theta_2 (\mu_t^* \cdot \Theta_1 + 1 - \mu_t^*) / (\mu \cdot \Theta_1 + 1 - \mu). \quad (10)$$

The number of unemployed in duration class 1–2 years in year t equals the product of the retention rate and the number of unemployed in duration class 0–1 years in year $t - 1$:

$$\begin{aligned} U_{1,t}^l &= (1 - \lambda_{1,t-1}^s) U_{1,t-1}^s, \\ U_{2,t}^l &= (1 - \lambda_{2,t-1}^s) U_{2,t-1}^s. \end{aligned} \quad (11)$$

Combining eqs. (3), (8) and (11) we get:

$$\mu_t^* / (1 - \mu_t^*) = \{(1 - \Theta_1 \cdot \lambda_{2,t-1}^s) \cdot \mu\} / \{(1 - \lambda_{2,t-1}^s)(1 - \mu)\}. \quad (12)$$

Finally we combine eqs. (10) and (12) to find:

$$\lambda_t^l / \lambda_t^s = \Theta_2 \{(1 - A \cdot \lambda_{t-1}^s)\} / (1 - \lambda_{t-1}^s) \quad (13)$$

in which

$$A = (\Theta_1^2 \mu + 1 - \mu) / (\Theta_1 \mu + 1 - \mu)^2.$$

From eq. (13) it appears that the ratio of escape probabilities from the two successive duration classes 0–1 and 1–2 years depends on both the duration parameter Θ_2 and the heterogeneity parameter A . Using observations of this ratio over time we may be able to distinguish between duration dependency and heterogeneity. If for example there is no heterogeneity, then $A = 1$ and the ratio of the escape probabilities should be constant over time.

Figure 3 shows the development of this ratio in the period 1980–1989. Obviously the ratio of escape probabilities fluctuates over time, indicating at least some heterogeneity.

We also use information on the escape probabilities from duration class 2–3 years. We define μ^{**} to be the share of type 1 unemployed in duration class 2–3 years, so:

$$\begin{aligned} U_{1,t}^z &= \mu^{**} U_t^z, \\ U_{2,t}^z &= (1 - \mu^{**}) U_t^z, \quad 0 < \mu^{**} < 1. \end{aligned} \quad (14)$$

We define:

$$\lambda_1^z / \lambda_1^s = \lambda_2^z / \lambda_2^s = \Theta_3. \quad (15)$$

Then we may derive in the same way as before:

$$\lambda_t^z / \lambda_t^s = \Theta_3 (\mu_t^{**} \cdot \Theta_1 + 1 - \mu_t^{**}) / (\mu \cdot \Theta_1 + 1 - \mu). \quad (16)$$

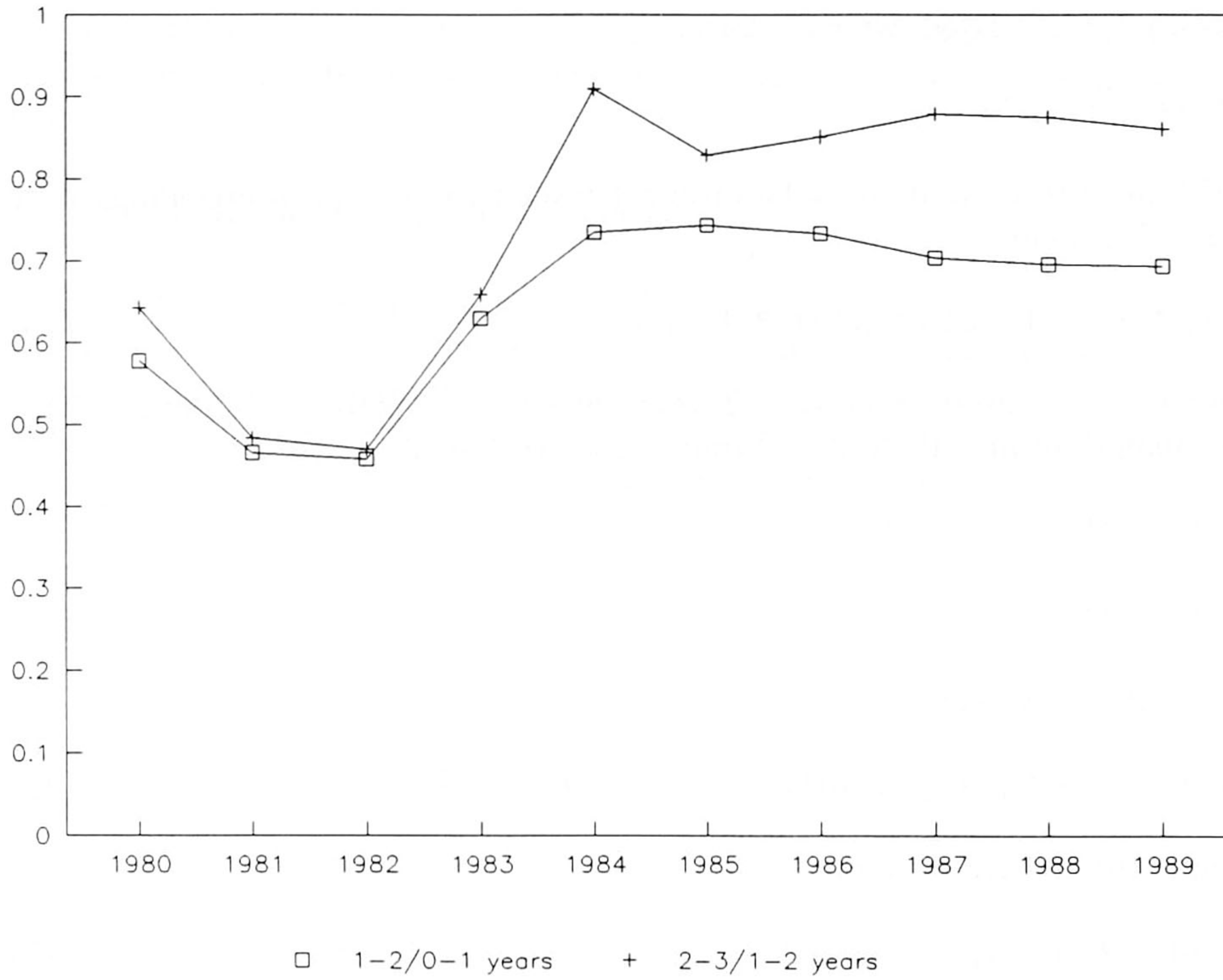


Fig. 3. Ratio of outflow probabilities from duration classes 0-1 and 1-2 years: 1980-1989.

And, also in the same way as before:

$$\begin{aligned}
 U_{1,t}^z &= (1 - \lambda_{1,t-1}^l)(1 - \lambda_1^s)U_{1,t-2}^s, \\
 U_{2,t}^z &= (1 - \lambda_{2,t-1}^l)(1 - \lambda_2^s)U_{2,t-2}^s.
 \end{aligned} \tag{17}$$

After rearranging we find:

$$\lambda_t^z / \lambda_t^l = \Theta_3 / \Theta_2 \{ (1 - C \cdot \lambda_{t-1}^l) \} / (1 - \lambda_{t-1}^l), \tag{18}$$

in which

$$C = (A - B \cdot \lambda_{t-2}^s)(1 - \lambda_{t-2}^s) / (1 - A \cdot \lambda_{t-2}^s)^2,$$

and

$$B = (\Theta_1^3 \mu + 1 - \mu) / (\Theta_1 \mu + 1 - \mu)^3.$$

Again, if there is no heterogeneity $A = B = 1$ and the ratio λ^z / λ^l is constant over time. As shown in fig. 3 this is not the case. Taking the logs of eqs. (13) and (18) we find:

$$\ln(\lambda_t^l) = \ln(\lambda_t^s) + \ln(\Theta_2) + \ln\{(1 - A \cdot \lambda_{t-1}^s) / (1 - \lambda_{t-1}^s)\}, \tag{19}$$

Table 1

Estimation results eqs. (19) and (20): 1984–1989 ^a.

Coefficient of	1	2	3
Θ_1	0.45 (0.05)	–	0.42 (0.01)
Θ_2	0.94 (0.07)	0.72 (0.01)	1 (–)
Θ_3	0.93 (0.10)	0.83 (0.01)	1 (–)
μ	0.51 (0.08)	–	0.51 (0.01)
R^2	0.915	0.837	0.926
ssr	0.0041	0.0097	0.0044

^a Standard errors between parentheses; R^2 is corrected for degrees of freedom; ssr = sum of squared residuals.

and

$$\ln(\lambda_t^z) = \ln(\lambda_t^l) + \ln(\Theta_3/\Theta_2) + \ln\{(1 - C \cdot \lambda_{t-1}^l)/(1 - \lambda_{t-1}^l)\}. \quad (20)$$

In a combined cross-section–time-series analysis over the period 1984–1989 we estimated the parameter μ , Θ_1 , Θ_2 and Θ_3 of eqs. (19) and (20), using non-linear least squares ¹. The estimation results are shown in table 1.

From the first estimate it appears that the heterogeneity parameters are significant. The value of μ indicates that both groups of unemployed have approximately the same size, individuals in one group having an escape probability about twice as large as the individuals in the other group. Furthermore it appears that the duration dependency parameters do not differ significantly from 1. In the second estimate we omitted the heterogeneity effect and used only duration dependence parameters to explain the difference in escape probabilities from the different duration classes. From an F -test it appears that the hypothesis that there is no heterogeneity cannot be accepted. In the third estimate we omitted duration dependency and now it appears that the hypothesis of no duration dependency cannot be rejected. The phenomenon that the escape probability from unemployment decreases with the duration of unemployment can be explained entirely by the phenomenon of heterogeneity. There is no indication of duration dependency.

4. Conclusions

In this article we analyze unemployment durations data derived from time series of the distribution of interrupted unemployment spells. It appears that the aggregate escape probability from unemployment decreases with the spell of unemployment. By analyzing the fluctuations in escape probabilities from different duration classes over time, we are able to make a distinction between the effect of duration dependency and heterogeneity on the aggregate escape probability. From an application to Dutch unemployment data it appears that the heterogeneity effect is the dominating effect. There is no indication of duration dependency with respect to individual escape probabilities. Therefore we conclude that the escape probabilities from long-term unemployment are smaller than those from short-term unemployment, not because they are stigmatized in any way, but because the most productive workers leave unemployment first.

¹ It appeared that estimations over the period starting in 1981 have a significant larger sum of squared residuals. A possible explanation for this is that the heterogeneity in the first duration class is, contrary to what we assume, not stable. A phenomenon possibly due to the increasing unemployment, in a period when many workers were fired.

References

- Gorter, C., P. Nijkamp and P. Rietveld, 1991, The duration of unemployment on the Dutch labour market: A proportional hazard model, *Regional Science and Urban Economics*, forthcoming.
- Groot, W.N.J., and A.G. ter Huurne, 1988, Re-employment probabilities of the Dutch young (IVA, Institute of Social Research, Tilburg University, Tilburg).
- Jackman, R. and R. Layard, 1990, Does long-term unemployment reduce a person's chance of a job? A time-series test, *Economica* 58, 93-106.
- Kooreman, P. and G. Ridder, 1983, The effects of age and unemployment on the duration of unemployment, *European Economic Review* 20, 41-57.
- Opstal, R. van and J. Theeuwes, 1986, Duration of unemployment in the Dutch youth labour market, *De Economist* 134, 351-367.
- Ridder, G., 1987, Life cycle patterns in labor market experience, Doctoral Dissertation (University of Amsterdam, Amsterdam).